Midterm 1 test

Level: 1st Year **Date: Thursday 10/04/2025**

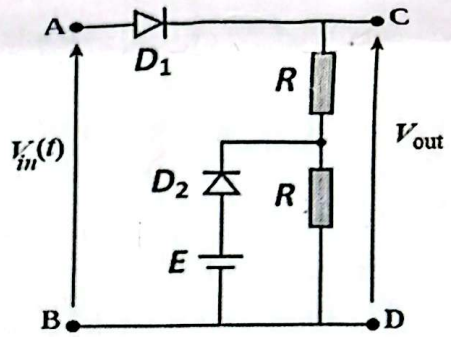
Material: Electronics Fundamental **Duration: 2h**

Exercise1: (5 points)

Assuming that the diodes in the circuit opposite are **ideal**, the **input voltage** is applied across points A and B, and **the output voltage** is measured across points C and D.

1. For each combination indicated in the table below, you are asked to:
   a. Provide the equivalent circuit diagram of the setup.
   b. Specify the condition(s) on the input voltage.
   c. Determine the expression of the output voltage.
2. Plot the transfer characteristic of the circuit.
3. Plot $V_{out}(t)$

We give: $V_{in}(t)=15\sin(\omega t)$, $E=10V$, $R=4\,k\Omega$

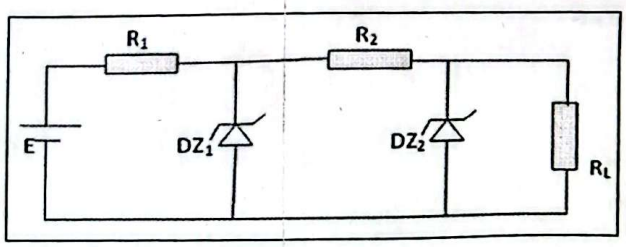


D1 State	D2 State	Condition on $V_{in}(t)$	$V_{out}(t)$
ON	ON		
ON	OFF		
OFF	ON		
OFF	OFF		

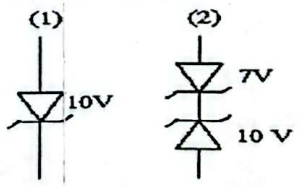
Exercise2: (5 points)

1. For the circuit shown in figure, calculate I_{Z_1} and I_{Z_2}

Given E=35V, $V_{Z_1} = 20V, V_{Z_2} = 10V$, $R_1 = 750\Omega$, $R_2 = 1k\Omega$ and $R_L = 2k\Omega$

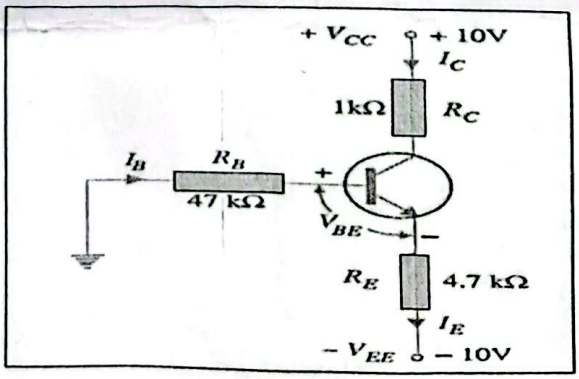


2. One of the following elements (1 and 2) shown opposite, is alternately connected in place of the Zener diode DZ_2. In each case, calculate the current I_L through R_L resistor



Exercise 3: (5 points)

1- Determine the Q point of the transistor circuit shown in the figure.
2- Determine the new Q-points when $V_{EE} = 5V$ *and* $15\,V$.
3- Draw the D.C. load line. Given β = 100 and V_{BE} = 0.7V.
Assume $V_{CE}(sat)$ = 0 V.



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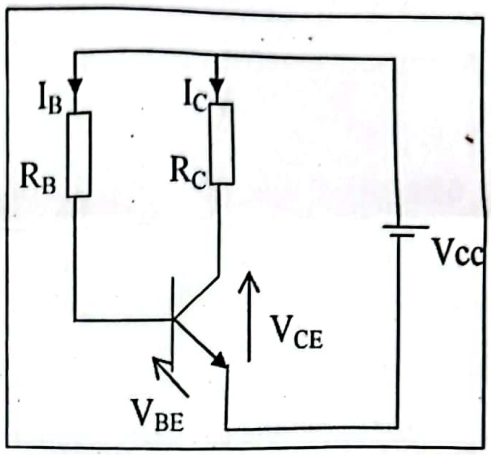
Exercise 4: (5 points)

We consider the following circuit that includes a transistor with a static current gain β=100, the voltage between the base and emitter is V_{BE}= 0.7 V, R_C=2 kΩ and V_{CC}=15V.



1. We desire to have ***5 mA*** through the resistor R_C, what value of resistance R_B should be chosen? Deduce V_{CE}.
2. If we vary R_B, then I_B varies, and thus I_C also varies. Taken a **null** value of V_{CE} at saturation, what is the maximum value that I_C can reach?.
3. What is the minimum value of I_B required to saturate the transistor?

Good Luck